DEVELOPMENT OF A FLOWCHART FOR ENHANCED RECOVERY AFTER SURGERY FOR ELECTIVE COLORECTAL SURGERY

by

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As members of the DNP Project Committee, we certify that we have read the DNP project prepared by *Sarah Weishaar*, titled *Development of a Flowchart for Enhanced Recovery After Surgery for Elective Colorectal Surgery* and recommend that it be accepted as fulfilling the DNP project requirement for the Degree of Doctor of Nursing Practice.

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Final approval and acceptance of this DNP project is contingent upon the candidate's submission of the final copies of the DNP project to the Graduate College.

I hereby certify that I have read this DNP project prepared under my direction and recommend that it be accepted as fulfilling the DNP project requirement.

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ABSTRACT

Enhanced Recovery After Surgery (ERAS) focuses on the surgical patient with implementation of evidence-based pathways to reduce the patient's surgical stress response, optimize their physiologic function, and facilitate recovery in all phases of surgery (American Association of Nurse Anesthetists [AANA], n.d.). The purpose of this Doctor of Nursing (DNP) project was to develop a flowchart with preoperative and intraoperative recommendations for patients scheduled for elective colorectal surgery with the aim of determining feasibility for implementation into practice. A survey adapted from the FAME (feasibility, appropriateness, meaningfulness, effectiveness) quantitative survey tool consisted of Likert-type questions (n=6), demographic data (n=2), closed-ended question (n=1) and open-ended question (n=1) assessed feasibility of an ERAS chart designed by the principle investigator (PI). A private anesthesia group practicing at a 99-bed community hospital in Hawaii included a convenience sample of anesthesia providers (n=8) as the participants. The survey was sent to participant's emails via SurveyMonkey with a 10-day time frame to respond. Participants who responded within the 10 days resulted in a 75% (n=6) response rate. Responses for overall quality of the guideline encompassing four questions resulted in weighted average Likert scores ranging from 3.67-4.17 resulting in an overall average of 3.1. Recommendations for use in practice resulted in most likely to use (40%, n=2), likely to use (10%, n=1), undetermined (10%, n=1) and least likely to use (40%, n=2). Findings determined the flowchart guideline quality was of average quality, half of participants would recommend, and half would not recommend this flowchart into practice. Future implications are to include a detailed decision tree for each area of recommendation and to include drug dosages to guide providers in more detail while caring for these patients.

INTRODUCTION

For 2018, 140,250 new cases of colorectal cancer were expected to be diagnosed in the United States (US), which totals 8.1% of all new cancer cases in the US (National Cancer Institute [NCI], 2018). It is the second leading cause of cancer related deaths affecting both men and women in the US with expected death rates of 50,630 per year with 71% of cancers arising from the colon and 29% from rectum (National Cancer Institute [NCI], 2018; Colorectal Cancer Alliance, n.d.). Depending on the type and stage of the cancer, treatment of colorectal cancer involves surgery to remove the cancer. Contemporary colorectal surgery is often associated with high costs, high rates of surgical site infection and long length of stay; eight days for open surgery and five days for laparoscopic surgery (American Society of Colon & Rectal Surgeons [ASCRS], n.d.). During the hospital stay for elective colorectal surgery, the incidence of perioperative nausea and vomiting (PONV) may be as high as 80% in patients with certain risk factors and readmission rates as high as 35.4% (ASCRS, n.d). An enhanced recovery protocol is a set of standardized perioperative procedures and practices that is applied to all patients undergoing a given elective surgery which has resulted in decreased complications.

The physiological stress response experienced by patients evoked by surgical procedures is profound and has potential to yield postoperative complications related to the surgical interventions themselves despite technology innovations and advanced techniques (Melnyk, Casey, Black, & Koupparis, 2011). These recommendations are designed to improve patient outcomes such as decreased postoperative nausea and vomiting, decreased pain, early return of bowel function and decreased length of hospital stay. This DNP project includes development of

a flowchart for anesthesia providers as a quick reference when caring for patients undergoing elective colorectal surgery.

Background Knowledge

In 1997, a group of general surgeons from Northern Europe with a background in colorectal fast track surgery developed the Enhanced Recovery After Surgery (ERAS) model (Taurchini, Del Naja, & Tancredi, 2018). Led by Henrik Kehlet, these surgeons formed a research group to explore the definitive care pathway for colorectal surgery patients. The driving force of ERAS methodology is to improve surgical patient outcomes by reducing hospital stay times, minimizing complication rates, shortening recovery times, and decreasing economic burdens (Taurchini et al., 2018). Implementation strategies are aimed specifically at decreasing costs and length of stay directly related to postoperative ileus following colorectal surgery with central aspects to minimize the body's surgical stress response by optimizing nutritional status, promoting opioid-free analgesia, and early postoperative feeding (Taurchini et al., 2018).

The group evolved over time, as colleagues from several other countries joined the research group and produced reports of improved time and quality of many different types of surgery (Taurchini et al., 2018). Initiation of the ERAS Society program began in Sweden, spread to the Netherlands, United Kingdom, and then to Switzerland and later extended to Canada, Australia, United States, France, Spain, and Latin America (Taurchini et al., 2018). The ERAS Society's successful growth was made official and registered in Sweden as an international non-profit medical academic society in 2010 (Pedziwiatr et al., 2018; Taurchini, Del Naja, & Tancredi, 2018). Members of the ERAS Society encompass different professions

involved in surgical care including surgeons, anesthetists, nurses, and allied health professionals (Taurchini, Del Naja, & Tancredi, 2018).

Several guidelines have been published by this society in a joint effort with other medical societies to help guide health professionals in promoting optimal perioperative care in the surgical arena. The original ERAS protocol created 20 focused items in the perioperative period; pre, intra and post-operative, which consisted of a research database of evidence to support implementation (Pedziwiatr et al., 2018). This growing evidence supports ERAS protocols in a multitude of surgical specialties including colorectal, gastric, pancreatic, esophageal and bariatric, in addition to non-gastrointestinal specialties (Pedziwiatr et al., 2018; Taurchini, Del Naja, & Tancredi, 2018).

Postoperative complications are under-reported problems that often trail surgical procedures and include problems such as atelectasis, aspiration pneumonitis, gastric ileus, poor wound healing, and surgical site infections (Patel et al., 2016). These complications have been associated with poor 30-day outcomes, an increase in hospital length of stay (LOS) from three to 10 days, and three times higher health care costs compared to other complications (Patel et al., 2016).

ERAS practice guidelines are comprised of surgical pathways designed to decrease the perioperative stress response and maintain pre-operative organ function thereby minimizing PC, achieving early recovery, and decreasing LOS (Melnyk et al., 2011). Factors such as prolonged fasting times, inadequate pain relief, increased opioid use, and bed rest impair pulmonary and gastrointestinal function leading to these postoperative complications which could be reduced or eliminated with ERAS pathways (Teeuwen et al., 2010). The ERAS pathways are multimodal

and incorporate rudiments of preoperative counseling, optimized fluid balance and nutrition, standardized analgesia and anesthesia, and prompt mobilization (Melnyk et al., 2011). Whole-body protein balance and muscle function may be restored, and insulin resistance avoided by implementing a preoperative carbohydrate beverage two-hours prior to surgery suggested by the ERAS pathways (Jones, Badger, & Hannon, 2011).

Local Problem

Barriers to implementing pre and intraoperative ERAS guidelines were identified at a community hospital in Hawaii. The individual elements of an ERAS pathway are beneficial with implementation and compliance resulting in improved outcomes such as patient satisfaction, shorter hospital stays and fewer complications (American Association of Nurse Anesthetists [AANA], n.d.). Although ERAS programs incorporate multiple interventions among many providers across a multitude of disciplines from admission to perioperative services, and through discharge, the stakeholders identified for ERAS implementation include surgeons, anesthesia providers and the patients. For this project, focus will be on the anesthesia providers, whom implement several elements of the ERAS pathway. Successful implementation of these guidelines evolves from leadership, creating a climate of change and engaging those involved in the care of patients undergoing colorectal surgery, such as surgeons and others involved in caring for these patients (AANA, n.d.).

Purpose

The purpose of this DNP project was to develop a flowchart with preoperative and intraoperative recommendations from the 2018 ERAS CPG for patients scheduled for elective colorectal surgery. As previously mentioned, the primary stakeholders for this project are the

anesthesia providers. The aim of this project was for these anesthesia providers to evaluate the feasibility of this flow chart to be adopted into their practice as a guide for preoperative and intraoperative interventions for the colorectal surgery patient.

Project Question

"Will anesthesia providers rate the ERAS flowchart as an overall quality guideline and would they implement this when caring for colorectal patients?"

Flowchart Development

The first ERAS guideline was published in 2005 and the fourth updated guidelines by the ERAS society (Appendix E) were published online November 2018 (Gustafsson et al., 2019). The society's recommendations have been supported with grading of evidence by the GRADE (grading of recommendations, assessment, development, & evaluation) system which is valid and reliable and are based on best available evidence; good-quality trials; meta-analyses of good-quality trials; or large cohort studies (Gustafsson et al., 2019). The PI developed this flowchart from the 2018 ERAS society guidelines for elective colorectal surgery which permits (copyright permission, Creative Commons Attribution 4.0 International License) unrestricted use to adapt their ERAS guidelines. There are 25 categories/recommendations (Table 1) for this guideline, but only 11 recommendations in areas of preoperative recommendation 2, 5, 7, 9, 10, 11 (red bolded), and intraoperative recommendation 6, 12, 13, 14, 18 (black bolded) was used as a focus of this flowchart.

TABLE 1. *ERAS® recommendations.*

1. Preadmission information, education and counseling.	
2. Preoperative optimization.	2. Preoperative Recommendation
3. Prehabilitation.	
4. Preoperative nutritional care.	
5. Management of anemia.	5. Preoperative Recommendation
6. Prevention of nausea and vomiting (PONV).	6. Intraoperative Recommendation
7. Pre-anesthetic medication.	7. Preoperative Recommendation
8. Antimicrobial prophylaxis and skin preparation.	
9. Bowel preparation.	9. Preoperative Recommendation
10. Preoperative fluid and electrolyte therapy.	10. Preoperative Recommendation
11. Preoperative fasting and carbohydrate loading.	11. Preoperative Recommendation
12. Standard anesthetic protocol.	12. Intraoperative Recommendation
13. Intraoperative fluid and electrolyte therapy.	13. Intraoperative Recommendation
14. Preventing intraoperative hypothermia.	14. Intraoperative Recommendation
15. Surgical access.	
16. Drainage of the peritoneal cavity and pelvis.	
17. Nasogastric intubation.	
18. Postoperative analgesia.	18. Intraoperative Recommendation
19. Thromboprophylaxis.	
20. Postoperative fluid and electrolyte therapy.	
21. Urinary drainage.	
22. Prevention of postoperative ileus.	
23. Postoperative glycemic control.	
24. Postoperative nutritional care.	
25. Early mobilization	

Preoperative Recommendations

Optimizing patients for surgery is important as anesthesia providers are involved directly or indirectly when planning an anesthetic plan for patients undergoing colorectal surgery. The flowchart focused on the following six recommendations in the preoperative period.

Recommendation 2: Preoperative Optimization

Alcohol abusers have two to three times the incidence of postoperative morbidity than individuals who do not drink. Alcohol consumption of more than two units equal a total of 50 milliliters (ml.) spirits 40% alcohol by volume (ABV), 150 ml wine 13% ABV, 500 ml 4% ABV beer or alcopop (a ready-mixed drink containing alcohol) of alcohol per day increases the rate of

postoperative infections. Preoperative abstinence of four weeks is recommended to make an impact on postoperative infections.

Smoking increases the risk of postoperative complications such as respiratory and wound healing complications (Feldheiser et al., 2016). Postoperative pulmonary complications can lead to ventilation and perfusion issues while the patient is under general anesthesia and potentially lead to prolonged ventilator assistance and/or infection. Abstinence is recommended for at least four weeks preoperatively. Pharmacological support as well as individual counseling should be offered to individuals so smoke and who abuse alcohol (Feldheiser et al., 2016).

Recommendation 5: Management of Anemia

Preoperative anemia is an independent predictor of mortality as well as postoperative complications (Feldheiser et al., 2016). Hemoglobin is a main determinant of oxygen delivery and levels should be corrected preoperatively due to an expected drop from blood loss and dilutional effects of intravenous fluids intraoperatively (Feldheiser et al., 2016).

Blood transfusion has long-term effects that are associated with an increase in morbidity mortality and should be avoided if possible (Feldheiser et al., 2016). Newer preparations of intravenous iron have a low risk of adverse reactions and are more effective than oral iron at restoring hemoglobin concentrations in both iron deficiency anemia and anemia of chronic disease (Feldheiser et al., 2016).

Recommendation 7: Preanesthetic Medications

Pharmacologic anxiolysis with long- or short-acting sedative medication (especially benzodiazepines and especially in the elderly) should be avoided if possible before surgery (Feldheiser et al., 2016).

Recommendation 9: Bowel Preparation

Mechanical bowel preparation (MBP) has been a long-standing practice that is often debated in colorectal surgery (Melnyk et al., 2011). The thought process behind its use is that it rids the large bowel of solid fecal material thereby minimizing the bacterial load contributing to postoperative complications (Melnyk et al., 2011). Up-to-date practices suggest that MBP liquifies solid feces and potentially increases intra-operative spillage of contaminant. This is due to the inability to contain the vast number of microorganisms that are present in the digestive tract in order to reduce bacterial load. Moreover, according to Melnyk et al., (2011), MBP causes metabolic disturbances through electrolyte depletion, as well as dehydration, abdominal pain/bloating, general fatigue, and carries a higher incidence of anastomotic leakage (Melnyk et al., 2011).

MBP alone with systemic antibiotic prophylaxis has no clinical advantage, can lead to dehydration, discomfort, and frequency of anastomotic leakage (Melnyk et al., 2011). MBP should not be used routinely in colonic surgery but may be used for rectal surgery (Feldheiser et al., 2016; Melnyk et al., 2011).

Recommendation 10: Preoperative Fluid and Electrolyte

Preoperative hydration deficits vary from patient to patient according to comorbidities, preoperative fasting, and use of MBP. Intraoperative fluid requirements are substantially reduced when prolonged preoperative fasting and MBP are avoided and CHO drinks are employed. Despite efforts to encourage patients to drink clear liquids when MBP is indicated, fluid and electrolyte derangements occur and should be corrected prior to general anesthesia (Feldheiser 2016; Pedziwiatr et al., 2018).

Patients should reach the anesthetic room in as close a state to euvolemia as possible and any preoperative fluid and electrolyte excesses or deficits should be corrected using individualized fluid administration strategies (Feldheiser et al., 2016).

Recommendation 11: Preoperative Fasting and Carbohydrate Loading

Metabolic stress, hyperglycemia, and insulin resistance is increased by prolonged preoperative fasting. These effects compound the surgical stress the body experiences during surgical procedures (Melnyk et al., 2011). Shortening the preoperative fasting time decreases insulin resistance while reducing protein loss and improving muscle function (Melnyk et al., 2011). Patients undergoing elective colorectal surgery should be allowed to eat up until six hours before surgery and take clear fluids including CHO drinks, up until two hours before initiation of anesthesia. Patients with delayed gastric emptying and emergency patients should remain fasted overnight or six hours before surgery.

Preoperative fasting times are of great concern for the anesthesia provider and often direct the technique chosen for the induction of anesthesia. Conventionally, fasting recommendations have been between 8-12 hours prior to surgery (Jones, Badger, & Hannon, 2011). The general order of "NPO after midnight" has been utilized as a blanket directive to ensure adequate fasting times for all patients.

Nil per os, or NPO. This is a Latin medical term that in its literal translation means "nothing through the mouth" (NPO, n.d.). This practice is applied to provide adequate fasting times, or withholding of solids and liquids, for surgical patients as to prevent aspiration of gastric contents into the lungs during general anesthesia ("Preoperative Guidelines for preoperative fasting", 2011). Potential pulmonary complications of aspiration include airway obstruction from

particles, chemical burns and inflammation from the gastric acid, and pneumonia caused by transferred bacteria (Jones, Badger, & Hannon, 2011).

In 2011, the American Society of Anesthesiologists (ASA) Committee on Standards and Practice Parameters systematically revised preoperative fasting guidelines according to highest level of evidence. Practice guideline recommendations for fasting from clear liquid intake was established to be safe for a minimum of two hours before elective procedures requiring general anesthesia, regional anesthesia, or monitored anesthesia care and refraining from solid food for a minimum of six hours before elective surgery ("Preoperative Guidelines for preoperative fasting," 2011; Jones, Badger, & Hannon, 2011). The aforementioned guidelines are intended for healthy patients of all ages undergoing elective procedures ("Preoperative Guidelines for preoperative fasting," 2011).

Carbohydrate-rich beverages are a component of the ERAS pathway that minimizes nitrogen and protein losses, maintains lean body mass and strength, and decreases insulin resistance while additionally reducing thirst, hunger, and anxiety by placing the patient in a metabolically fed condition (Jankowski, 2017)

Intraoperative Recommendations

The intraoperative period is when surgical stress is the greatest due to general anesthesia and the surgical procedures themselves. It is critical to provide care during maintenance of anesthesia that will hasten functional recovery and improve the postoperative outcomes. Anesthesia providers directly affect recovery and patient outcomes through intraoperative management choices. Employing specific pharmacologic therapies and modalities to maintain

total body homeostasis enhance the recovery of colorectal surgery patients. The chart will focus on the following five recommendations in the intraoperative period.

Recommendation 6: Prevention of PONV

There are many risk factors that predispose patients to PONV and therefore a multimodal approach to PONV prophylaxis should be considered in all patients and incorporated into ERAS protocols (Feldheiser et al., 2016). A multimodal approach incorporates antiemetic medications as well as a total intravenous anesthetic (TIVA) instead of inhalational agents and nitrous oxide (Feldheiser et al., 2016). Factors such as reduction of fasting, CHO loading, adequate hydration, and high-inspired oxygen concentrations all play a role in reducing prevalence of PONV (Feldheiser et al., 2016). Additionally, the use of regional anesthetic techniques and the use of non-steroidal anti-inflammatory drugs (NSAIDs) indirectly influence PONV occurrence by opioid-sparing methods (Feldheiser et al., 2016).

The different classes of antiemetics are based on the antagonism of different kinds of central receptors to include serotonergic, dopaminergic, cholinergic, and histaminergic. When used independently, these agents are only effective in reducing PONV by 25% or less (Feldheiser et al., 2016). Combination therapy is more effective than monotherapy, with a combination of two to three antiemetic agents and TIVA being most effective in reducing PONV incidence for high-risk patients (Feldheiser et al., 2016). Rescue therapy should be with an antiemetic from a different class if PONV is present postoperatively (Feldheiser et al., 2016).

Aggressive PONV prevention should be implemented intraoperatively. Patients with one to two risk factors (Figure 1) should receive a combination of two antiemetics (Feldheiser et al.,

2016). TIVA and opioid-sparing strategies in combination with two to three antiemetics should be applied when a patient has three to four PONV risk factors (Feldheiser et al., 2016).

Patient Specific	Anesthetic Related	Surgery Related
• Female gender	• Use of volatile anesthetics	• Duration of surgery > 1 hour
• Age less than 50 years old	• Use of nitrous oxide	• Type of surgery (particularly laparoscopy)
• Nonsmoker	• Higher intraoperative and postoperative doses of opioids.	
• History of PONV		
• History of motion sickness		

(Adapted from Odom-Forren, J. (2014). Ch. 50: Postanesthesia recovery. In J. Nagelhout & K. Plaus, *Nurse Anesthesia*. St. Louis, MO: Elsevier Saunders.)

FIGURE 1. Postoperative nausea and vomiting risk factors.

Recommendation 12: Standard Anesthetic Protocol

Recommendations include the use of short-acting anesthetics, cerebral monitoring to improve recovery by reducing the risk for postoperative delirium, monitoring of neuromuscular blockade level, and complete reversal of neuromuscular block.

Recommendation 13: Intraoperative Fluid and Electrolyte Therapy

Intraoperative fluid therapy should be aimed at administering a balanced crystalloid solution to cover the needs of salt-water homeostasis. The goal of perioperative fluid therapy is to maintain fluid homoeostasis avoiding fluid excess and organ hypoperfusion. Intraoperative fluid therapy aims at maintaining a near-zero fluid balance and avoiding substantial weight gain of 2.5 kilogram (kg). or more (Feldheiser et al., 2016). The risk of pulmonary complications, prolonged ileus, and delayed recovery are all increased with excessive crystalloid administration (Feldheiser et al., 2016). A restrictive approach with a maintenance intravenous (IV) rate of

crystalloid at 3 ± 2 milliliter/kilogram/hour (mL/kg/hr.) will sufficiently meet intraoperative fluid requirements (Feldheiser et al., 2016). Balanced isotonic crystalloid solutions should be preferred, and 0.9% sodium chloride solutions should be avoided to minimize the risk of associated hyperchloremia and kidney dysfunction (Feldheiser et al., 2016).

Goal-directed fluid therapy (GDFT) is performed by bolus administration of IV solution and uses objectives of hypovolemia aiming to maintain central normovolemia by utilizing changes in stroke volume measured by minimally invasive cardiac output monitors (Feldheiser et al., 2016). GDFT should be reserved for high-risk patients and in patients undergoing surgery with large intravascular fluid loss (blood loss and protein/fluid shift) (Feldheiser et al., 2016) (American Association of Nurse Anesthetists, n.d.).

Recommendation 14: Preventing Intraoperative Hypothermia

Perioperative hypothermia is defined as a core temperature below 36° Celsius and is an adverse outcome commonly experienced during anesthesia (Feldheiser et al., 2016). In most patients undergoing general anesthesia, hypothermia results due to an internal core-to-peripheral redistribution of body heat that decreases the core temperature by 0.5-1.5° Celsius within the first 30 minutes following induction of anesthesia (Feldheiser et al., 2016). Inadvertent hypothermia occurs in 50-90% of patients undergoing laparoscopic or open surgery with older adults being more prone to heat loss (Feldheiser et al., 2016). Feldheiser et al., (2016), reports that there is a significant reduction in wound infections, cardiac complications, bleeding and transfusion requirement when inadvertent hypothermia during major abdominal surgery is prevented (Feldheiser et al., 2016). Furthermore, immune function is improved, post anesthesia recovery

time is decreased, and overall survival rates improve when loss of body heat is prevented by utilizing active warming devices

Reliable temperature monitoring should be undertaken in all colorectal surgical patients and methods to actively warm patients (forced air warming systems, circulating water garments, or warmed IV solutions) to avoid intraoperative hypothermia should be employed in cases lasting longer than 30 minutes (Feldheiser et al., 2016). Combined strategies along with preoperative warming should be employed in vulnerable groups (Feldheiser et al., 2016).

Recommendation 18: Postoperative Analgesia

Avoid opioids and apply multimodal analgesia in combination with spinal/epidural analgesia or TAP blocks when indicated. Avoiding opioids lead to early ambulation, earlier return of bowel function, decreased complications and reduction in hospital stay (Carmichael et al., 2017).

SYNTHESIS OF EVIDENCE

Enhanced recovery after surgery (ERAS) pathways have promising potential to improve patient outcomes. When appropriately employed, ERAS pathways decrease length of stay (LOS) by 35-40% and average health care costs decline by 28-32% (Parrish, 2016). These statistics are achieved through incorporation of the ERAS components that improve PONV, postoperative pain, and postoperative mobilization. Institutions further benefits from an efficient perioperative program that has clearly written guidelines accessible to staff and reduce the potential for errors in care provision (Parrish, 2016). Quality of life outcomes and patient satisfaction are also improved related to the patients' ability to return to work and increase productivity sooner than

with traditional surgical care. Additionally, institutional potential to service a greater number of patients increases with sooner recoveries and discharges (Parrish, 2016).

Despite underpinned support from the evidence, postoperative complications continue to persist all the while ERAS programs lag in both implementation and adherence. Anesthesia providers play an integral role within the perioperative team and is considered chief stakeholders in ERAS program operation. To depict the benefits of ERAS pathways on patient outcomes and to evaluate professional education of the anesthesia providers, a comprehensive appraisal of evidence was conducted using PubMed, the Cochrane Library, and Google Scholar as the primary resources in evidence collection. Initially, PubMed was searched using key words "*ERAS,"* "*ERAS outcomes,*" "*ERAS effectiveness*," and "*ERAS barriers.*" The PubMed yield was 734 and was further narrowed to 154 applying the 'clinical trials,' 'full text,' 'within five years of publication,' and 'free full text' filters. A second search was conducted in PubMed to extend the search results using the search terms (eras) OR "*enhanced recovery*" AND ("Education, Medical, Continuing" [Mesh] OR "Education, Nursing, Continuing" [Mesh] OR education). The yield of this search included 342 studies and was narrowed down to 195 with the five-year filter application. The terms "*colorectal*" was entered in the remainder of these articles. After reviewing the abstract of these articles, a total of 11 articles were collected, assessed, and synthesized (Appendix A) as they convey to the purpose of this project.

Strengths

In addition to safety and efficacy of ERAS pathways common themes identified within the research include quality of patient care and improved outcomes associated with standardization. A meta-analysis conducted by Li et al. (2018), utilized RCTs that compared fast-

track recovery with conventional strategies. Outcome measures revealed significant decrease in LOS, hospital charges, and overall complication rates.

Substantiating this research were the results of the retrospective analysis conducted by Nikodemski et al. (2017). Utilizing a patient-oriented nursing philosophy to guide the process, the study aimed to evaluate whether a significant difference in LOS existed between a hysterectomy control group without ERAS implementation and a hysterectomy study group with ERAS implementation (Nikodemski et al., 2017). Data was extracted from the medical records of 100 patients in each group, totaling 200 participants. Findings within the ERAS study group revealed a decrease in PONV pharmacological intervention, significantly reduced postoperative analgesia with morphine, a decrease in LOS, and postoperative early mobilization in 45% of the ERAS patients as compared to none in the control group. Although not found statistically significant, the postoperative complication rate was found to be less in the ERAS study group (17 vs. 23; $p = 0.06$) (Nikodemski et al., 2017). The structured primary evidence review piloted by Childers et al. (2018) concurred that the vast body of literature supports enhanced recovery pathways (ERPs), despite the varied level of strength of the evidence due to the clearly supportive patient outcome improvements by many of the ERAS interventions.

Weaknesses

What may be the greatest strength of ERAS programs also appears to be its greatest weakness. ERAS pathways are adaptable to a variety of patients, cases, and facilities making it applicable to almost any type of surgical patient. The ERAS programs incorporate a multitude of evidence-based interventions rooting that postoperative outcomes will improve, and recovery will be accelerated, however components of these programs vary on many different levels. This

literature review extracted that the variability in programs has led to a lack of uniformity of studies furthering a deficit in consistency and standardization.

In 2011, a systematic review within the Cochrane Library investigated the effectiveness and safety of the ERAS pathways through the evaluation of whether the protocols yield less morbidity and whether LOS was decreased. Their research yield included four RCTs that were analyzed with an inclusion of 237 patients (119 ERAS & 118 conventional) (Spanjersber, Reurings, Keus, & Van Laarhoven, 2011). This meta-analysis determined that LOS in the ERAS sample was significantly reduced. Overall complications were shown to be decreased though major complications were not reduced. These reports suggest that the research for ERAS protocol implementation does not currently support standard of care due to the lack of specificity and reportedly low quality of data (Spanjersber et al., 2011).

Gaps

The evidence suggests that patient outcomes are directly related to ERP adherence. A retrospective review by Parrish et al. (2018) analyzed data from 14 Southern California Kaiser Permanente hospitals over a 14-month period to evaluate outcome associations with the completion rate of a designed ERP checklist. Adherence rates had a wide variance of 38-96% among the facilities limiting the application of this study. The weight however, was revealed in the significantly decreased postoperative pain demonstrated in the outcomes of 23 patients who received the entire eight-element standardized protocol (max pain score 0.43 vs 2.1) (Parrish et al., 2018). A database review by Mata et al. (2017) examined adherence to perioperative ERPs with the aim to identify risk factor associations for quality improvement strategies. PONV in the

first 24 hours following surgery was found to be associated with poor adherence in either patient participation and/or the clinical team (Mata et al., 2017).

The gaps in the research lie in the causes or influence of poor adherence rates. Associations are often made with a lack in knowledge or awareness but remain multifactorial. With aims to gain insight into the influences of implementation and adherence, Herbert et al. (2017) enlisted qualitative research methods to collect the experiences and opinions of healthcare professionals implementing an ERAS program through audio recorded and transcribed semi-structured interviews.

Leadership amongst surgeons and nurses, teamwork, and education of both staff and patients were among some of the facilitating factors identified by this study while keeping ERAS visible, stakeholder buy-in, and spreading the program were at the forefront in identified challenges of ERAS implementation and adherence (Herbert et al., 2017). Pecorelli et al. (2017) evaluated the implementation of a mobile device app that was designed to support and record surgical recovery for ERPs. Data collection was executed through the device app with real-time assessment of program adherence and patient reported outcomes. Participants achieved an improved recovery goal, as well as enhanced understanding, usability, and satisfaction reported by participants (Pecorelli et al., 2017).

ERAS programs that have established a solid degree of adherence have robust components of perioperative education and training among staff and patients alike. The research of Francis et al. (2018), and Keller, Delaney, Senagore, and Feldman, (2017), determine that gaps in training and knowledge deficits lead to a lack in program sustainment. ERAS program

adoption and implementation adherence could likely be improved by addressing stakeholder buy-in through policy development and staff education.

The literature review revealed an overwhelming amount of studies that pertained to the safety and efficacy of ERAS programs and the improved outcomes that they impart upon surgical patients. The weaknesses identified within the literature zero in on poor implementation and adherence. Additionally, poor adherence lends to poor outcomes pointing to the need for further studies to determine barriers associated. Knowledge gaps and awareness have both been identified as common threads within the research that have potential to lead to program sustainment through policy development and educational activities.

Conceptual Framework

The Promoting Action on Research Implementation in Health Services (PARiHS) framework guided the development and implementation of this project, designed to improve postoperative outcomes. The use of the PARiHS model is targeted for those wanting to implement evidence found in research as well as those researching implementation (Rycroft-Malone & Bucknall, 2011). Rycroft-Malone & Bucknall, (2011), inform readers that the basis of the PARiHS format is founded on the concept analysis approach by Morse et al. (1996), which emphasizes the three fundamental concepts of evidence, context, and facilitation (Rycroft-Malone & Bucknall, 2011).

The first two main elements, *evidence* and *context*, with applicable sub elements are best for outlining a layout for developing a clinical decision flowchart for the promotion of improved postoperative outcomes (Rycroft-Malone & Bucknall, 2011). An evidence based guideline by the ERAS society was the foundation of a flowchart developed by the PI. This guideline was based

on the best available evidence and graded by using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) system. Facilitation, the last main element, involves facilitating evidence into practice. Facilitators include the PI of the project who is instrumental in providing evidence and recommendations as a guide while anesthesia providers are the key to implementing the flowchart at their facility. The PARIHS framework labors to abstractly and realistically guide evidence-based practice changes effectively through the use of credible research (Rycroft-Malone & Bucknall, 2011).

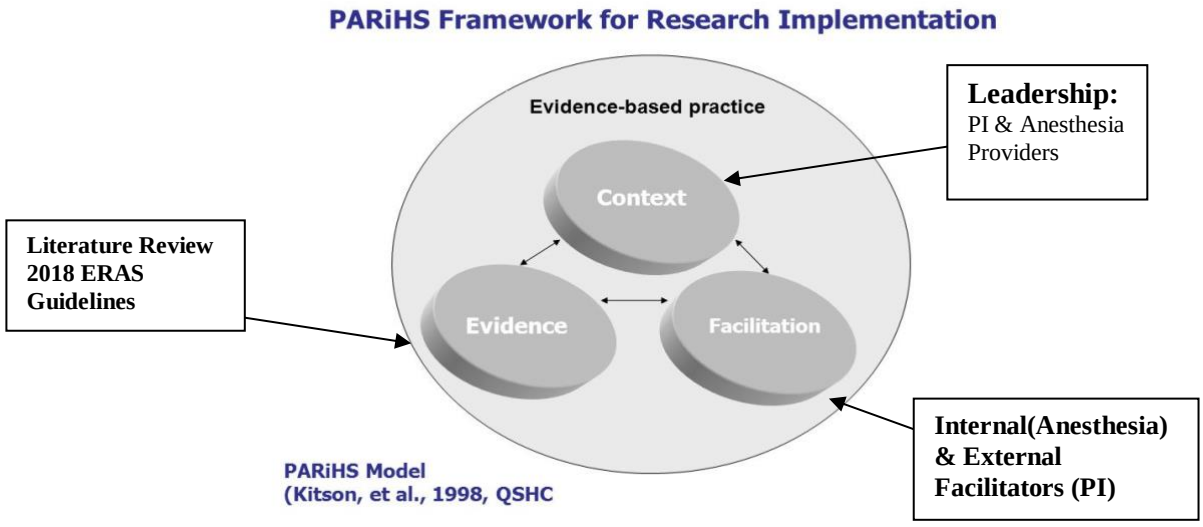


FIGURE 2. Adaptation and customization of the promoting action on research implementation in health services. (Adapted from Rycroft-Malone, J., & Bucknall, T. (2011). *Models and frameworks for implementing evidence-based practice: Linking evidence to action* (ed.). Malden, MA: Wiley-Blackwell.)

Concepts

Several concepts are entailed in the PARiHS framework which guided this project.

Evidence

Evidence is the initial part of the PARiHS framework model. Within this element the sub elements of research, clinical experience, patient experience, and local data emerge (Rycroft-

Malone & Bucknall, 2011). Concentrated facilitation is crucial when assimilating diverse forms of evidence (Rycroft-Malone & Bucknall, 2011). The PARiHS framework endeavors to guide a participatory process that is at very least complex, and melds the evidence of science and experience (Rycroft-Malone & Bucknall, 2011). Evidence gathered through the literature review as well as using the ERAS society guidelines guided this project.

Context

Context indicates the situation in which the change of practice is be executed. Culture, leadership, and evaluation is outlined as the three chief sub elements related to context of the PARiHS model (Rycroft-Malone & Bucknall, 2011). This standard recognizes the convolution of healthcare practices and how associations affect transformation (Rycroft-Malone & Bucknall, 2011). Evaluative tools such as the clinical decision flow chart designed for this project translates evidence into practice. The survey addressing feasibility of the flowchart allows for feedback for improvement and change on performance and implementation. These tools are regarded in context and cultivate an environment that recognizes the need for fluid modification as the process develops (Rycroft-Malone & Bucknall, 2011).

Facilitation

The last main element is facilitation or successful implementation of this DNP project. The PI was only focused in the facilitation process of developing the flowchart for anesthesia providers to decide if they want to implement this into their practice. The project involved the foundation for them to expand areas of recommendation into this flowchart to make it more feasible for their practice.

Application

The practical elements and the conceptual principles of the PARiHS framework allow for an effective assimilation of the suggested clinical project. A clinical decision flowchart was created based on the 2018 ERAS guidelines for scheduled colorectal surgery. A survey tool adapted from the Joanna Briggs FAME tool was utilized to determine feasibility for use of the flowchart among anesthesia providers.

Multiple layers affect and complicate changes in practice. Despite validated high-quality research; there is often a delay of implementation into practice due to the organization requiring the process change as well as the levels of administration and authority to make the modification (DiCenso, Guyatt, & Ciliska, 2005). The PARiHS framework acknowledges the context, culture, and facilitation needed to yield a highly effective change in process while allowing for practical and conceptual understanding. Conducting a feasibility assessment helps to illuminate barriers to implementation.

Ethical Considerations

The ethical principles every person should be aware when carrying out a project include informed consent, respect for persons, beneficence and justice.

Informed Consent

This project informed all participants of the project purpose and aim. A welcome letter (Appendix E) ensured participants of their voluntary participation and confidentiality of their answers. Confidentiality was maintained without collection of identifying criteria. Disclosures and consent was obtained prior to project commencement.

Respect for Persons

This project focused on the assessment of a clinical flowchart created using the 2018 ERAS Guidelines for colorectal surgery. The project site is a surgical department at a small community hospital in Hawaii and project participants are anesthesia staff. Approval from the University of Arizona Institutional Review Board (IRB) was obtained (Appendix H) prior to beginning this project and was determined that this project did not involve human research. Hospital IRB approval was not necessary at this site as the providers are not hospital employees.

Beneficence

There was no direct patient involvement and participation of participants was voluntary, posing no more than minimal risk to participants. There was no compensation for participation. Information obtained was anonymized without the use of identifiable personal information and data collection was performed by the DNP student only.

Justice

Project aims will benefit patients by optimizing the preoperative and intraoperative care of colorectal surgery patients by following 2018 ERAS guidelines translated to a flow chart to further lead to sustained change in practice. All participants were given the opportunity to withdraw or not participate in the survey.

METHODS

The PI developed a flow chart of preoperative and intraoperative recommendations from the 2018 ERAS guideline for scheduled colorectal surgery. This flow chart was evaluated for feasibility for implementation by the anesthesia providers in a community hospital in Hawaii.

The Feasibility, Appropriateness, Meaningfulness, and Effectiveness (FAME) standardized critical appraisal tool was used to evaluate the quality of the clinical flow chart.

The FAME tool was developed by the Joanna Briggs Institute Levels of Evidence and Grades of Recommendation Working Party October 2014 (Joanna Briggs Institute [JBI] of Evidence, 2014). This tool, adapted for this project is designed to provide clarity to users of levels of evidence and address common feedback (JBI of Evidence, 2014). It incorporates four key factors: Feasibility, Appropriateness, Meaningfulness, and Effectiveness. The rating system utilizes a binary system for recommendations with the options being: 'strong' or 'weak' (JBI of Evidence, 2014). Letters are used to represent the strength of the recommendations, with Grade A being a 'strong' recommendation, and Grade B representing a 'weak' recommendation (JBI of Evidence, 2014). The ERAS guidelines have been evaluated for strength of recommendation, the FAME will be used to rate overall quality of the guideline.

Design

The preoperative recommendations (n=6) and intraoperative recommendations (n=5) of the ERAS guideline for colorectal surgery was summarized into a flow chart for easy visualization guiding the ERAS pathway. The flowchart was emailed to a convenience sample of anesthesia providers (n=8) who evaluated the feasibility of this flowchart by answering an anonymous survey sent to them via SurveyMonkey. The survey, (Appendix F) adapted from the Joanna Briggs FAME survey tool was attached to the flow chart to determine feasibility of the flowchart.

Participants

The participants include a convenience sample of anesthesia providers (N=8) at a 99-bed community hospital in Hawaii. The chief of anesthesia approved site authorization (Appendix B) and site IRB approval was not needed as anesthesia providers are not hospital employees.

Data Collection

Email addresses were sent to the PI by the chief of anesthesia for information about project details. A welcome letter explaining the project, the 2018 ERAS guidelines for colorectal surgery and the flowchart was sent to participants via email with a SSL encrypted link to SurveyMonkey to take the survey. The survey remained open for ten days.

Security for Data Collection

Survey dissemination was initiated remotely through email transmission by the PI via a link provided by SurveyMonkey. SurveyMonkey is a survey platform that allows users to create surveys to allow for feedback that improves engagement and provides actionable insight (SurveyMonkey, 2019). The survey link contained SSL encryption to ensure security of data, information, or identifiable private information when connecting to secure SurveyMonkey servers (SurveyMonkey, 2019). All the data collected was securely retained in the PI's SurveyMonkey account for three days and all data was deleted after data analysis was collected (SurveyMonkey, 2019).

Data Analysis

SurveyMonkey uses automated processes and machine learning to analyze responses to aggregate answers in order to identify trends (SurveyMonkey, 2019). The scores from the FAME survey was evaluated and analyzed for each question. The results for overall guideline quality

were summated on a weighted average score. The open-ended question analyzed comments pertaining to this question. Demographic questions, professional title and years of experience, is described.

RESULTS

The survey was closed 10 days after the initial email went out to all participants. Participants who responded within the 10 days resulted in a 75% (n=6) response rate.

Participant Population

Participants (Figure 3) who responded included CRNA's (n=4) and anesthesiologists (n=2).

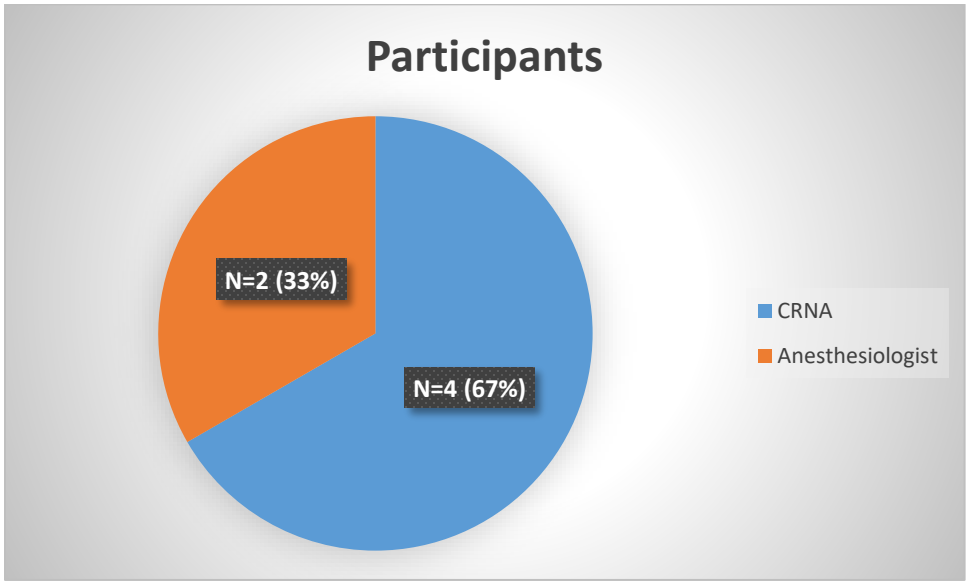


FIGURE 3. Participants professional title.

Years of Experience

Years of anesthesia experience for the majority of participants 60% (n= 3) were 10-20 years, followed by > 20 years (n=2) and < than 5 years (n=1) (Figure 4).

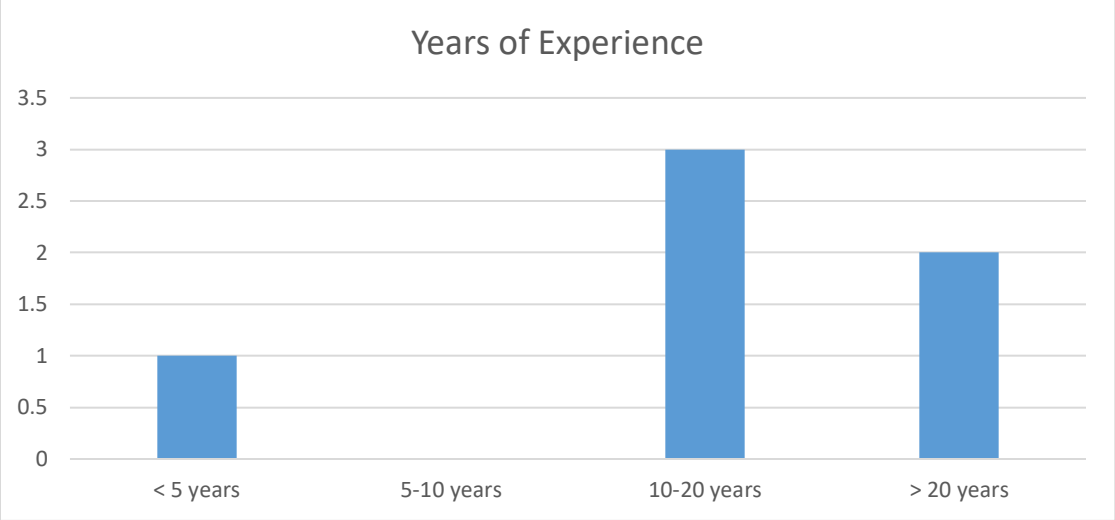


FIGURE 4. Years of experience.

Likert Questions

Question 1-6 were rated according to a Likert scale ranging from least likely (1) to most likely (5). Question 1 included the first four questions of the survey.

Question 1

This section rated the overall quality of the flowchart. This section rating the *development, presentation, guideline quality* and *completeness* of the flowchart. The overall average score for each section was greater than 3.65 (Table 2).

TABLE 2. *Likert scale rating for overall quality of flowchart* (*Question 1).*

	1	2	3	4	5	TOTAL	WEIGHTED AVERAGE
The quality of the flowchart development.	16.67% 1	0.00% 0	16.67% 1	16.67% 1	50.00% 3	6	3.83
The quality of the flowchart presentation.	16.67% 1	0.00% 0	16.67% 1	16.67% 1	50.00% 3	6	3.83
The quality of the flowchart guidelines.	0.00% 0	16.67% 1	16.67% 1	0.00% 0	66.67% 4	6	4.17
The completeness of the flowchart.	16.67% 1	16.67% 1	0.00% 0	16.67% 1	50.00% 3	6	3.67

Question 5

How likely are you to recommend the use of this flowchart in practice? (Figure 5). Participants will most likely (n=2) recommend use of this flowchart in practice, while participants (n=2) will least likely use this flowchart in their practice, participants (n=1) not likely use this flowchart in practice and participants (n=1) has not determined use in practice.

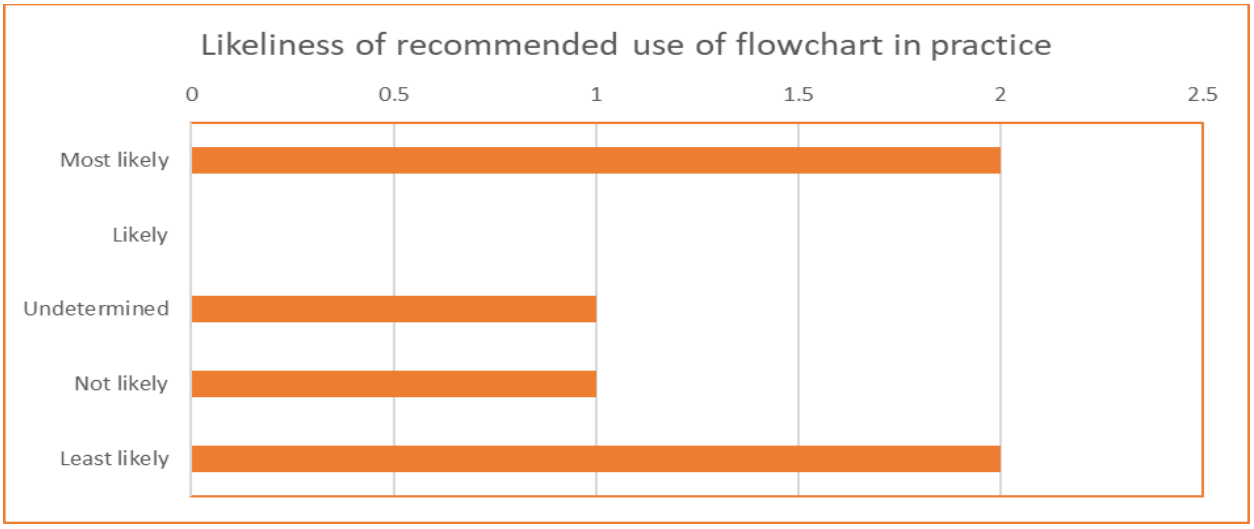


FIGURE 5. Likely to recommend use of flowchart in practice.

Question 6

How likely would you refer to this flowchart in your professional decision making? Participants were likely (n=1) and most likely (n=2) to use these recommendations in their professional decision making while the remainder of participants were least likely (n=1) and not likely (n=2) to use this in their professional decision making (Figure 6).

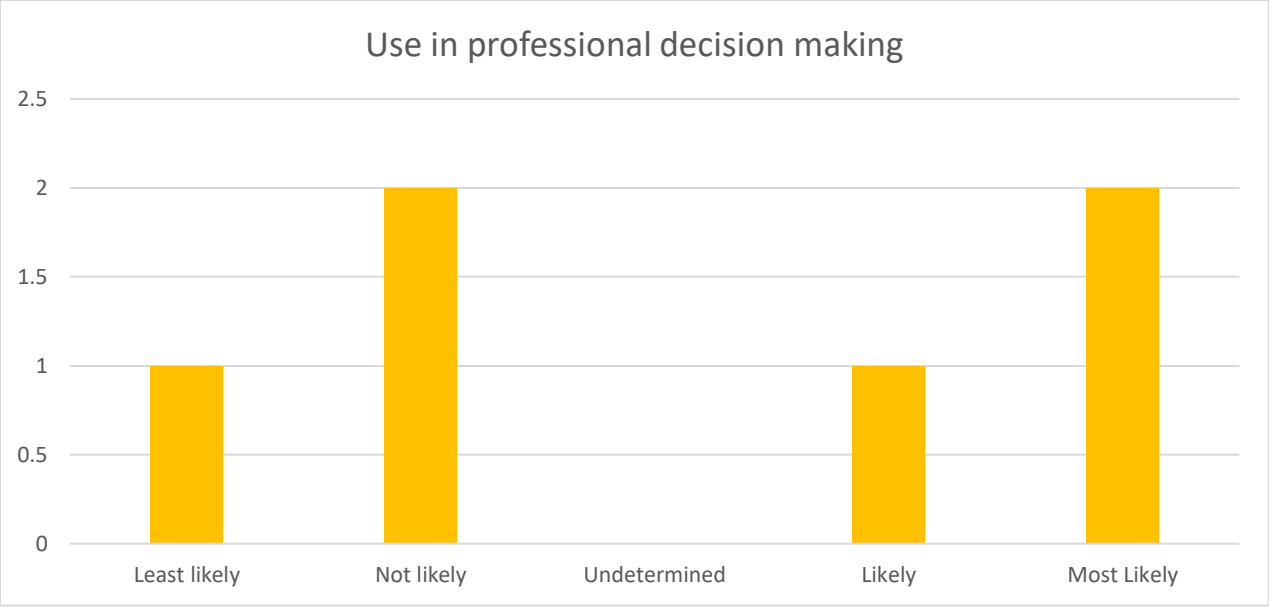


FIGURE 6. Likely to refer to this flowchart in professional decision making

Question 7

Have you seen these recommendations prior to viewing this flowchart? 100% of participants (n=6) have read or are aware of these ERAS recommendations prior to this survey which assumes all providers are aware of current evidence related to their practice.

Comments

There was an opportunity for participants to enter comments regarding the chart. Comments included lack of a decision tree and lack of medication dosages.

DISCUSSION

Discussion of Results

Survey results indicated the quality of the ERAS flowchart was of average quality, with 40% (n=2) of participants most likely to recommend, 40% (n=2) least likely to recommend, 20% (n=1) not likely, and 20% (n=1) undetermined if they would implement this flowchart into practice. These findings indicated the overall quality of the flowchart were average with the lowest scores in the area of "completeness of flowchart." Survey comments included lack of medication dosages and decision tree. With a few modifications of the flowcharts in response to survey comments, the ERAS flowcharts would likely be beneficial to the practice majority and promote translation into practice for elective colorectal surgery patients.

Project Strengths and Limitations

The strength of this project was the response rate (75%) which was valuable in evaluating this flowchart for future additions to this flowchart so this information can be presented to other stakeholders at this facility. Limitations from this project included time constraints for both the PI and the participants. The time frame to complete the survey was short and some participants were away at an anesthesia conference which could be a factor for not having a 100% response rate, although a 75% response rate is very strong. The time frame to develop the flowchart was short as this was not the initial planned project. Another limitation is that more open-ended questions could have been added to determine why or why not participants would implement this into practice. It was discovered after project completion and results related to the project site, most participants use these recommendations in their practice, but are not able to carry out all aspects due to individual surgeon practices which are not current evidence. Suggestions are to

revise the flowchart for completeness and present the evidence to the surgeons so all providers are up to date on current evidence to ensure ERAS guidelines are followed to improve patient outcomes.

DNP Essentials

As a graduating SRNA, all elements of the DNP essentials were completed either through didactic classroom assignments, during clinical rotations and with this DNP project. I grew from a novice SRNA and have developed into an advanced practice nurse (APN) with new skills learned to lead and make changes in healthcare. This DNP project involved the design, implementation, and evaluation of a flowchart for ERAS. The DNP essentials demonstrated in this project are listed below.

Essential I: Scientific Underpinnings for Practice

The PI integrated the DNP Essential I: Scientific underpinnings for practice, during the course of this project by applying the PARiHS conceptual theory to develop strategies to enhance health care delivery through ERAS flowchart development (American Association of Colleges of Nursing [AACN], 2006). The main elements, *evidence* and *context*, were utilized for outlining a layout for developing a clinical decision flowchart for the promotion of improved postoperative outcomes (Rycroft-Malone & Bucknall, 2011).

Essential II: Organizational and Systems Leadership for Quality Improvement and System Thinking

This essential was utilized during the development of this project by conceptualizing ERAS as a new care delivery model for a community hospital in Hawaii with a focus on the

elective colorectal surgical patient population served. The ERAS protocol flowcharts for preoperative and intraoperative management aim to improve patient and healthcare outcomes.

Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice

For the purposes of this project a literature review was conducted, and the evidence was critically appraised to determine and implement the best body of evidence for practice. An ERAS flowchart was designed aligning the evidence to evaluate quality improvement methodologies for the promotion of safe, timely, effective, efficient, and equitable patient-centered care, fulfilling DNP Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice (AACN, 2006).

Essential VIII: Advanced Nursing Practice

This project embodied the DNP Essential VIII: Advanced Nursing Practice, by designing and evaluating an ERAS flowchart for the purposes of improving patient outcomes through evidence-based practices (AACN, 2006). This project guided and supported anesthesia providers in moving toward improved outcomes through a best practice model (Taurchini, Del Naja, & Tancredi, 2018).

Dissemination

Results from the survey was submitted to the chief of anesthesia of the department with a discussion for future implications of successful implementation. This project was presented at the 2018 Arizona Association of Nurse Anesthetists Spring “Sun and Fun” conference as a poster presentation.

APPENDIX A:

SYNTHESIS OF EVIDENCE

Author/Article	Qual: Concepts or phenomena Quan: Key variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
Childers et al., (2018)	Focus emphasis on potential components of the protocol relevant to anesthesia providers.	None	Structured primary evidence review of MEDLINE identifying systematic reviews, randomized trials, and observational studies	N=16 reviewed components (surgical bins) 10 preoperative components, 1 intraoperative component, and 5 postoperative components. Anesthesia components reported separately in Appendix A Table A1	MEDLINE searches conducted between January and August 2017. Articles included if systematic reviews, randomized controlled trials (RCT), or observational designs that focused on TKA or THA.	Vast body of literature supporting enhanced recovery pathways (ERPs) for total joint surgeries. Varied level of strength of the evidence between components, but evidence overall clearly supportive of pt outcome improvements by many of the interventions.
Francis et al. (2018).	Determine consensus on key elements of ERAS training curriculum from expert panel and establish factors central to successful implementation.	Effective multi-disciplinary teamwork (MDT), strong leadership, and ERAS facilitator is essential to a framework aimed at successful implementation.	Modified Delphi study conducting 3 rounds of questioning to an expert group between January 2016 and February 2017 and an interactive focus group of ERAS novices at the ERAS international conference April 27-30, 2016.	Responding experts to round one questionnaire N=35 Round two N=33 Round three N=21 Focus Group N=12	E-mail invitation to experts for participation. Data analysis based on percentage response rates with reported weighted average scores for consensus data for each question.	Several elements added to existing components of final round questionnaire following second round focus group presentation: “Awareness of ERAS among the team” “Patient-reported outcome measures” “Readiness of discharge”

Author/Article	Qual: Concepts or phenomena Quan: Key variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
						And "Complications." Expert consensus achieved for training and implementation proposing a detailed ERAS training and assessment curriculum as well as an implementation strategy to ensure sustained application of ERAS and improvement of pt outcomes.
Guillame et al. (2017).	Primary outcome: Functional exercise capacity.	None	Parallel-arm single-blind randomized control trial.	Pts assigned to a once weekly supervised pre-habilitation (PREHAB+, N=41) or standard rehabilitation (REHAB, N=39).	Functional exercise capacity determined by 6-minute walk test distance (6MWD). CHAMPS questionnaire used to determine exercise quantity, intensity, and energy expenditure.	Weekly supervised exercise session did not improve postoperative walking capacity or program compliance as compared to standard REHAB care.

Author/Article	Qual: Concepts or phenomena Quan: Key variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
Herbert et al. (2017).	Aims: to gain understanding of facilitating factors and challenges of implementing an ERAS program to gain insight to implementation and adherence.	Normalisation Process Theory (NPT)	Qualitative research methods.	Experiences and opinions of healthcare professionals implementing the program N=26	Semi-structured interviews conducted with consent, audio-recording, and verbatim transcription by approved service	Challenges identified: keeping ERAS visible, stakeholder buy-in, spreading the program, segmental approach, resources Facilitating factors identified: alignment with EBP, cohesive and visible leadership amongst surgeons and nurses, teamwork, staff education, pt involvement and education.
Kahokehr et al. (2009).	Essential concepts identified for successful implementation: -Patient counselling -Teamwork -Attitude change	None	Literature review	Surveys from 4 Northern hemisphere hospitals.	Expert opinion narrative.	ERAS protocol implementation varies by institution and should therefore be protocol driven with strict adherence to ensure progress and consistency.

Author/Article	Qual: Concepts or phenomena Quan: Key variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
Keller, Delaney, Senagore, & Feldman, (2017).	Aim: to define SAGES member's awareness and use of enhanced recovery principles and practice.	None	Online 48 question survey designed by SAGES Surgical Multimodal Accelerated Recovery Trajectory (SMART) committee members with reminders sent out 2 and 3 weeks later encouraging survey completion.	SAGES members Survey respondents N=229	Web-based survey	Determined a need for preoperative care education and standardization. National organization endorsement would augment implementation.
Li et al. (2018).	To investigate the effectiveness and limitations of ERAS in laparoscopic liver resection in China. ERAS group elements included increased perioperative education, nurse navigators, nutrition support, respiratory therapy, oral carbohydrate, early mobilization, early	None	Randomized controlled single-blind trial for laparoscopic liver resection patients from August 2015 to August 2016.	Laparoscopic liver resection patients at Sir Run Run Shaw Hospital of Zhejiang University. ERAS group N=58 Traditional care group N=61	Primary outcome measure: Hospital length of stay (LOS) defined by days of surgery to hospital discharge. Evaluated secondary outcomes: complications (utilizing Comprehensive Complication Index [CCI] and Clavien-Dindo classification), hospital costs, pain scores (utilizing visual analogue scale	Postoperative LOS significantly shorter in ERAS group (5 vs. 8 days; $p<0.001$). Hospital costs significantly reduced by ERAS program ($p=0.0006$). Complications significantly reduced in ERAS program (36.2 vs 55.7%; $p=0.033$). In ERAS group PONV and duration

Author/Article	Qual: Concepts or phenomena Quan: Key variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
	oral intake, goal-directed fluid therapy, PONV prophylaxis, and multimodal analgesia.				[VAS]), and 30-day readmissions. Pt follow up for 1 month following discharge completed for both groups recording mortality, morbidity, and readmission rates. Data collection instruments used for study unclear.	to first flatus significantly reduced and pain control improved. ERAS protocol safe and achievable for laparoscopic liver resection. Pts experience less pain and less complications in ERAS group.
Mata et al. (2018).	Does identifying risk factors for lower adherence help design quality improvement strategies? Aims: to estimate the extent to which patient, procedural, and organizational factors predict adherence to postoperative enhanced recovery pathways (ERPs) in laparoscopic colorectal surgery.	None	Database review and analysis of ERP registry undergoing elective laparoscopic colorectal surgery between 2012 and 2014.	N=223 Mean age 60 (48% male)	Data collection completed by dedicated auditor visiting pts daily from September 2012 to December 2014. Data entered into the ERAS Interactive Audit System. Independent clinical researcher supplemented database with medical chart reviews and electronic medical	Mean adherence to ERP patient participation (PP) bundle 79% (65-93% for individual elements). Adherence for clinical team (CT) bundle 82% (range 68-98%). PONV in first 24 hr was associated with poor adherence to either bundle.

Author/Article	Qual: Concepts or phenomena Quan: Key variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
	Primary outcome measure of interest: adherence to postoperative ERPs.				records to calculate Charlson Comorbidity Index furthering complication characterization.	
Nikodemski et al. (2017).	Establish the progress of the ERAS pathway implementation in a gynecologic department. Primary aim of the study: to evaluate if there was a significant difference in LOS between groups.	Patient-oriented nursing philosophy assumed to guide the entire process.	Retrospective analysis of two sets of 100 consecutive medical records: hysterectomy pts treated pre-ERAS pathway implementation and following ERAS implementation between July 2014 and June 2015.	Hysterectomy Control group (pre-ERAS) N=100 Hysterectomy Study group (ERAS implementation) N=100	Data extracted from medical records. Preoperative interview with interactive discussion to discuss proposed management, planned method of surgery, anesthesia and postoperative pain relief determinations.	PONV requiring pharmacological intervention reduced in ERAS group (6% vs. 23%; p=0.0001) Additional postoperative analgesia with morphine significantly reduced in ERAS group (12 pts vs 80 pts; p<0.0001) Post-operative early mobilization achieved in 45% of ERAS pts on day of surgery vs. none in control group (p<0.0001). Median LOS in ERAS group 6 days

Author/Article	Qual: Concepts or phenomena Quan: Key variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
						vs. 7 days in control group (p=0.0001). Postoperative complication rate greater in control group (pre-ERAS), however not statistically significant (23 vs. 17; p=0.06).
Parrish, et al. (2018).	Outcome evaluation of a modified ERAS protocol for ambulatory anorectal surgery.	None	Retrospective review	14 Southern California Kaiser Permanente medical centers utilizing an 8-item protocol standards checklist for anorectal procedures.	Prospective adherence and outcome data collection over 14-month period and was retrospectively reviewed.	Checklist completion rate varied by facility from 38-96%. Lowest adherence rates for preoperative carbohydrate treatment (2-89%) and least divergent for preoperative prescriptions (92-100%).
Pecorelli et al. (2017).	Evaluation of the implementation of a health information technology	None	Prospective, single-group, pilot study	Received intervention N=45	Data collection through mobile device app recording adherence and real-	Participants reported high usability and satisfaction with

Author/Article	Qual: Concepts or phenomena Quan: Key variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
	designed to support surgical recovery and record adherence to enhanced recovery programs (ERPs) for bowel surgery patients.				time assessment of patient reported outcomes (PROs).	app, as well as improved recovery goal achievement through enhanced understanding with the assistance of the app.

APPENDIX B:

SITE APPROVAL LETTER

[redacted] Anesthesia Providers
Kealakekua, HI 96750

02/10/2019

University of Arizona Institutional Review Board
c/o Office of Human Subjects
1618 E Helen St.
Tucson, AZ 85721

Please note that Ms. Sarah Weishaar, UA Doctor of Nursing Practice student, has permission from the anesthesia department, who are not hospital employees, to submit her DNP project to our anesthesia providers practicing at a community hospital in Hawaii. She plans on presenting to us, a quick flow chart for " Enhanced Recovery After Surgery for Elective Colorectal Surgery".

Ms. Weishaar will develop a flowchart according to the ERAS 2018 guidelines. Our group will evaluate the flowchart for feasibility of implementation at our facility. Our plan is to "sell" it to stakeholders; surgeons, at this community hospital. Ms. Weishaar will not be involved in the process of presenting the flowchart to the surgeons at this facility as they are hospital employees. Ms. Weishaar's activities will be completed and presented to our department no later than *May 19, 2019.*

Ms. Weishaar has agreed provide to my office a copy of the University of University IRB approval before she starts her project.

If there are any questions, please contact my office at 808-960-2256.

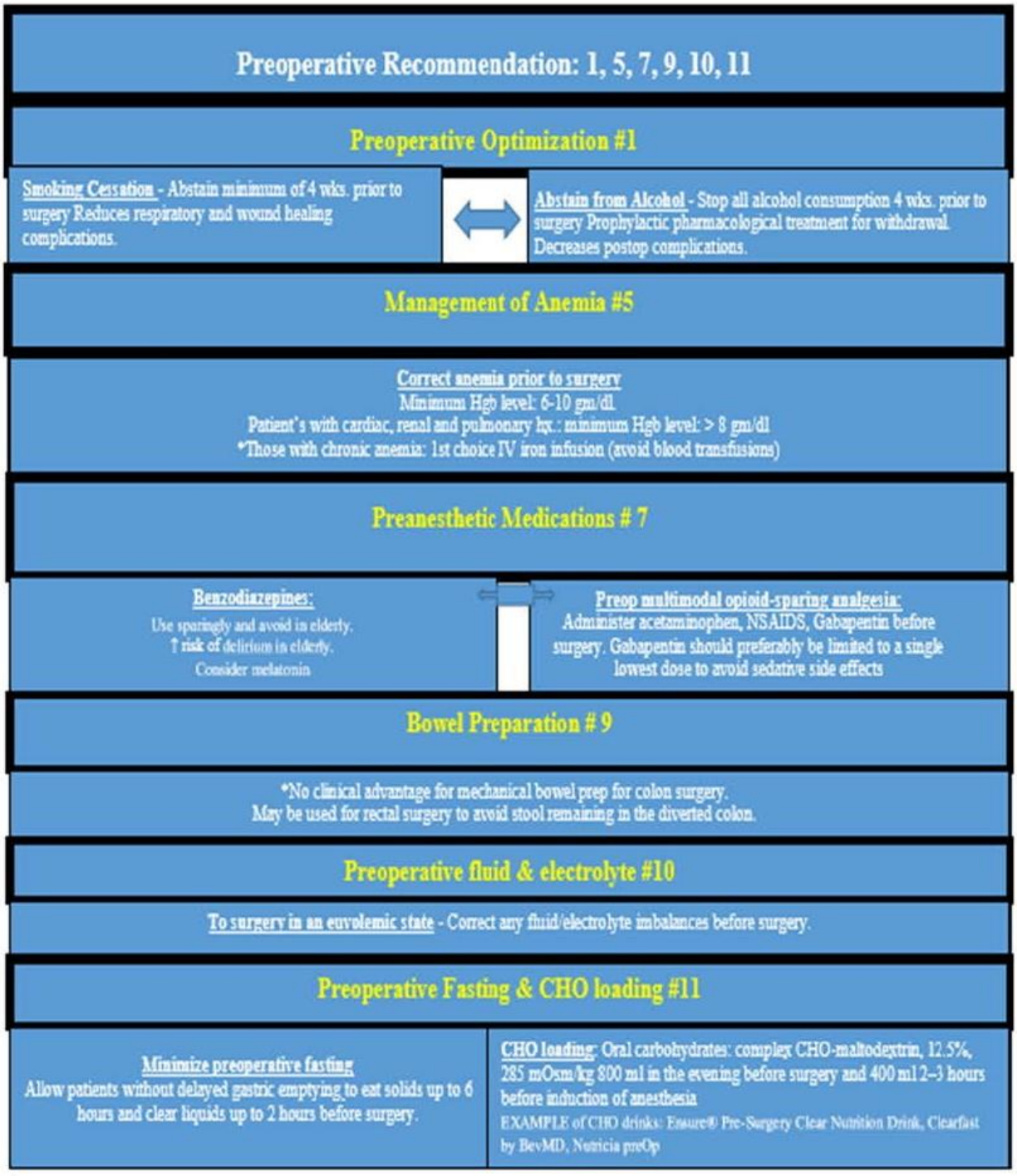
Signed,

Elizabeth Groshong D.O.
Chief of Anesthesia Department
[redacted]**Hospital**

APPENDIX C:

FLOWCHART FOR PREOPERATIVE RECOMMENDATIONS

Flowchart for 2018 ERAS Recommendations for Colorectal Surgery:
Preoperative Recommendations relevant for anesthesia providers

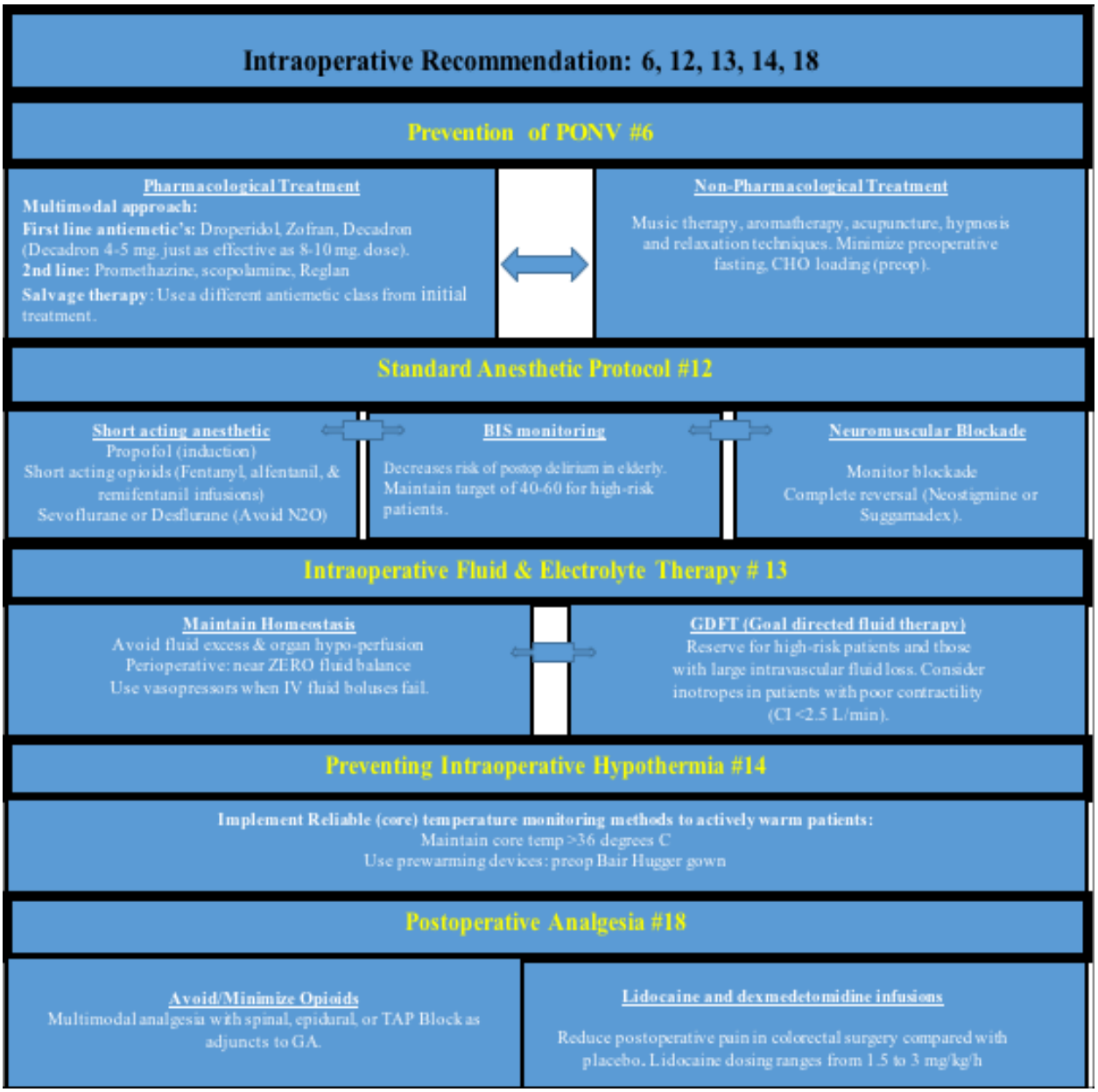


Flowchart adapted from ERAS society guidelines for scheduled colorectal surgery. (Gustafsson, U.O., Scott, M.J., Hubner, M. et al. World J Surg (2019) 43: 659. https://doi.org/10.1007/s00268-018-4844-y, under a Creative Commons Attribution 4.0).

APPENDIX D:

FLOWCHART FOR INTRAOPERATIVE RECOMMENDATIONS

Flowchart for 2018 ERAS Recommendations for Colorectal Surgery:
Intraoperative Recommendations relevant for anesthesia providers



Flowchart adapted from ERAS society guidelines for scheduled colorectal surgery. (Gustafsson, U.O., Scott, M.J., Hubner, M. et al. World J Surg (2019) 43: 659. https://doi.org/10.1007/s00268-018-4844-y, under a Creative Commons Attribution 4.0).

APPENDIX E:

PARTICIPANT WELCOME LETTER

Participant Welcome Letter

Dear Participants

My name is Sarah Weishaar and I am a student registered nurse anesthetist in the DNP-nurse anesthesia program at the University of Arizona. I am submitting a condensed flowchart of ERAS recommendations for elective colorectal surgery focusing on the preoperative and intraoperative phase of surgery which can be implemented at your facility. Please review the flowchart and fill out the survey which will be sent via Survey Monkey. Your name will be anonymous and no data will be linked to your email address. The survey consists of 7 Likert-type questions to assess the flowchart. Deadline for returning the survey will be one week after receiving the email.

Completing the survey and participating in this project is completely voluntary, and implies informed consent. If you decide to participate, all data collected will remain confidential and anonymous. Information collected will be used to determine if your department agrees this is a feasible chart which can be presented to stakeholders at your facility. At this time, the PI has no plans to publish the information gathered from this project. The University of Arizona Institutional Review Board has deemed this project "not human research".

Your choice to participate is entirely voluntary with no known risks. You may choose to decline or stop participation at any time during the appraisal. Your decision to decline or stop participation will be respected and will not affect any future relationship with the University of Arizona.

For questions, concerns, or complaints related to this project, please feel free to contact the principle investigator, Sarah Weishaar at sweishaar@email.arizona.edu or (602) 762-8528. If you have questions or concerns regarding your rights as a participant in this project or to discuss project-related concerns, you are encouraged to contact the Human Subjects Protection Program at University of Arizona.

Thank you for your time and consideration in supporting my DNP project.

Sarah Weishaar, BSN, RN, SRNA-DNP
sweishaar@email.arizona.edu (602) 762-8528

APPENDIX F:

GUIDELINES FOR PERIOPERATIVE CARE IN ELECTIVE COLORECTAL SURGERY: ENHANCED RECOVERY AFTER SURGERY (ERAS®) SOCIETY RECOMMENDATIONS: 2018

Guidelines for Perioperative Care in Elective Colorectal Surgery: Enhanced Recovery After Surgery (ERAS®) Society Recommendations: 2018

(Link to document shown below)

https://link.springer.com/content/pdf/10.1007%2Fs00268-018-4844-y.pdf

APPENDIX G:

FAME (FEASIBILITY, APPROPRIATENESS, MEANINGFULNESS AND EFFECTIVENESS) SCALE

Developed by the Joanna Briggs Institute Levels of Evidence and Grades of Recommendation Working Party October 2013

The FAME (Feasibility, Appropriateness, Meaningfulness and Effectiveness) scale may help inform the wording and strength of a recommendation.

F – Feasibility What is the cost effectiveness of the practice? Is the resource/practice available? Is there sufficient experience/levels of competency available?

A – Appropriateness

Is it culturally acceptable? Is it transferable/applicable to the majority of the population? Is it easily adaptable to a variety of circumstances?

M – Meaningfulness Is it associated with positive experiences? Is it not associated with negative experiences?

E – Effectiveness Was there a beneficial effect? Is it safe? (i.e is there a lack of harm associated with the practice?

JBI Grades of Recommendation	
Grade A	**A 'strong' recommendation for a certain health management strategy where (1) it is clear that desirable effects outweigh undesirable effects of the strategy; (2) where there is evidence of adequate quality supporting its use; (3) there is a benefit or no impact on resource use, and (4) values, preferences and the patient experience have been taken into account.**
Grade B	**A 'weak' recommendation for a certain health management strategy where (1) desirable effects appear to outweigh undesirable effects of the strategy, although this is not as clear; (2) where there is evidence supporting its use, although this may not be of high quality; (3) there is a benefit, no impact or minimal impact on resource use, and (4) values, preferences and the patient experience may or may not have been taken into account.**

APPENDIX H:

FLOWCHART SURVEY

Flowchart Survey

1. Rate the overall quality of the flow chart development

1	2	3	4	5
Least quality				Most quality

2. Rate the overall quality of the flow chart presentation.

1	2	3	4	5
Least quality				Most quality

3. Rate the completeness of the flow chart.

1	2	3	4	5
Least complete				Most complete

4. Rate the overall quality of the flow chart guidelines.

1	2	3	4	5
Least quality				Most quality

5. How likely are you to recommend the use of this flow chart in practice?

1	2	3	4	5
Least likely				Most likely

6. How likely would you make use of a flow chart of this quality in your professional decision making?

1	2	3	4	5
Least likely				Most likely

7. How many years of anesthesia experience do you have?
   A. < five years
   B. Five to 10 years
   C. 10 to 20 years
   D. > 20 years

8. What is your professional title?
   A. CRNA
   B. Anesthesiologist

9. Prior to viewing this flowchart, have you seen these recommendations?
   A. Yes
   B. No

10. What would you add to the flowchart?

APPENDIX I:

THE UNIVERSITY OF ARIZONA INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL LETTER

THE UNIVERSITY OF ARIZONA
Research, Discovery & Innovation

Human Subjects Protection Program

1618 E. Helen St.
P.O.Box 245137
Tucson, AZ 85724-5137
Tel: (520) 626-6721
http://rgw.arizona.edu/compliance/home

Date:	March 08, 2019
Principal Investigator:	Sarah Weishaar
Protocol Number:	1903418721
Protocol Title:	Development of a Flow Chart Designed from Enhanced Recovery After Surgery Guidelines for Perioperative Care in Elective Colorectal Surgery
Determination:	Human Subjects Review not Required

Documents Reviewed Concurrently:

Regulatory Determinations/Comments:

- Not Research as defined by 45 CFR 46.102(l): As presented, the activities described above do not meet the definition of research cited in the regulations issued by U.S. Department of Health and Human Services which state that "Research means a systematic investigation, including research development, testing, and evaluation, designed to develop or contribute to generalizable knowledge. Activities that meet this definition constitute research for purposes of this policy, whether or not they are conducted or supported under a program that is considered research for other purposes. For example, some demonstration and service programs may include research activities. For purposes of this part, the following activities are deemed not to be research."

The project listed above does not require oversight by the University of Arizona.

If the nature of the project changes, submit a new determination form to the Human Subjects Protection Program (HSPP) for reassessment. Changes include addition of research with children, specimen collection, participant observation, prospective collection of data when the study was previously retrospective in nature, and broadening the scope or nature of the study activity. Please contact the HSPP to consult on whether the proposed changes need further review.

The University of Arizona maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00004218).

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